Stockton Lake
1999 Water Quality Report

1. **General**.

a. **Project location**. Stockton Dam is located approximately 2 miles east of Stockton, Missouri, at river mile 51.4 on the Sac River, a tributary of the Osage River. The project watershed encompasses 1,160 square miles.

b. **Authorized project purposes**. Flood control, hydroelectric power, drinking water supply, low flow supplementation, and water quality are the primary project purposes; equally important, however, are its fish and wildlife resources and recreation benefits.

c. **Pertinent data**.

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1,000 A.F.)	Surface Area (acres)	Shoreline (miles)
Flood Control	892.0	779.4	38,200	
Multipurpose	867.0	878.3	24,900	300
Inactive		9.3*		
Total		1,657.7		

Total Drainage area: 1,160 sq. miles
Average Annual Inflow: 832,679 acre-feet

* Contained in multipurpose pool

2. **Activities and studies of the year**.

The Water Quality Unit (PM-PR-W) conducted a water quality survey of Stockton Lake, outlet, and major tributaries on 28 & 29 July 1999. Ambient profiling of temperature, dissolved oxygen (DO), conductivity, pH, and oxidation reduction potential (orp) or redox; measurement of photic zone and secchi depths; and surface, photic zone, and near bottom water sample collections were performed. The Unit performed the following laboratory analyses: turbidity, suspended solids (TSS), fecal coliform, chlorophyll, atrazine, alachlor, metolachlor, and cyanazine. In addition, the Chemical and Materials Quality Assurance Laboratory (CMQAL) performed ammonia nitrogen, nitrite/nitrate nitrogen, total kjeldahl nitrogen, total phosphorus, and total orthophosphorus analyses. Monitoring of the tailwater continuous water quality instrumentation was performed by project personnel. And maintenance and calibration of the equipment were the responsibility of Water Control personnel.

3. **Existing Conditions**.

a. **Inflow**. The Little Sac River east of Walnut Grove (ST-10) exhibited a slightly depressed DO concentration (5.6 mg/L) on 29 July (Table 1). Other ambient parameters (temperature, conductance, pH, and orp) were within normally expected ranges for the low-flow summer conditions. Total nitrogen (TN) and total phosphorus (TP) concentrations of 1.99 mg/L and 0.27 mg/L, respectively, exceeded the generalized eutrophy criteria for streams (1 mg/L and 0.1 mg/L, respectively). The nutrient concentrations in the Little Sac River were higher than the levels present in the three other tributaries surveyed. Over the period of record, it has been noted that an upstream sewage treatment plant and a landfill impact the stream. Turbidity and total suspended solids (TSS) were low at 9.4 NTU and 16 mg/L, respectively. The only herbicide detected was cyanazine, and its concentration of 0.16 ug/L was well below the MCLG for drinking water supplies (1 ug/L). Sons Creek (ST-14) exhibited a DO concentration of 3.6 mg/L, which was well below the State minimum standard (5 mg/L). Other ambient parameters were within normally expected ranges. The TN and TP concentrations of 0.54 mg/L and 0.07 mg/L, respectively, indicated moderately enriched conditions in the lake headwaters/stream reach. High water clarity was present based on the turbidity (7.4 NTU) and TSS (6.8 mg/L). Herbicides were either extremely low or not detected in the small creek. The Big Sac River south of Dadeville (ST-20) also exhibited a slightly depressed DO concentration (5.9 mg/L) on 29 July. Other ambient parameters were within expected ranges. Total nitrogen and TP concentrations (1.48 mg/L and 0.1 mg/L, respectively) were slightly elevated, but still within acceptable eutrophy ranges. Turbidity (13 NTU) and TSS (20 mg/L) were reasonably low. And no herbicides were detected in the stream. Turnback Creek at Dade County Rd O Bridge (ST-43) exhibited a satisfactory DO concentration (6.6 mg/L) in the July survey. Other ambient parameters were also within satisfactory seasonal and discharge ranges. Nutrient levels were within satisfactory eutrophy ranges (TN, 1.19 mg/L and TP, 0.07 mg/L). Turbidity and TSS (12 NTU and 21 mg/L, respectively) were moderately low. And no herbicides were detected in the stream.

b. **Lake**. Ambient profiling in the down lake area near the dam revealed severely stratified conditions in the 28 July survey. The temperature differential between surface and bottom waters was 12.6^{o}C inside the weir (ST-3) and 19.2^{o}C up lake of the weir (ST-25). A thermocline and an oxycline were present between 6 and 7 m in the 28-m water column of ST-3 and the 26-m water column of ST-25. The hypolimnion (depths greater than 7 m) of both areas was anoxic. Mesotrophic nutrient levels were present at ST-25. The TN and TP concentrations in the surface waters were 0.12 mg/L and 0.03 mg/L, respectively. The latter is well below the generalized eutrophy criterion of 0.05 mg/L. Turbidity was extremely low (3.3 NTU) in this down lake area. The secchi and photic zone depths of 2.74 m and 9.14 m, respectively, were indicative of the high water clarity. Algal biomass or standing crop, however, was very low based on the chlorophyll concentration of 2.6 ug/L. No herbicides were detected in the down lake area.

The Little Sac arm above the Hwy 245 Bridge (ST-7) was also severely stratified with a 17.3^{o}C differential between surface and bottom waters. A thermocline and an oxycline were present between 3 & 4 meters in the 16-m water column. The epilimnion (upper 3 meters of the water column) was supersaturated with DO concentrations above 8.5 mg/L. The high DO

concentrations were, presumably, the result of algal photosynthesis in the clear water conditions (turbidity and TSS of 2.7 NTU and 2.2 mg/L, respectively). However, chlorophyll concentrations were moderately low at 6.7 ug/L, despite reasonably good water clarity (secchi and photic zone depths of 3.05 m and 5.49 m, respectively) and moderately enriched conditions (TN and TP concentrations of 0.11 mg/L and 0.03 mg/L in the surface waters). Depths below 6 m were essentially anoxic. No herbicides were detected in this portion of the lake.

The Big Sac arm above the Ruark Bluff Recreation Area (ST-13) exhibited equally severe stratification with a 17.4^{o}C differential between surface and bottom waters. The thermocline and oxycline were also between 3 & 4 m in the 17-m water column. The epilimnion (upper 3 meters of the water column) was again supersaturated with DO concentrations above 8.4 mg/L. Water clarity was moderately good with secchi and photic zone depths of 1.98 m and 5.18 m, respectively. The turbidity and TSS (3.2 NTU and 3.3 mg/L, respectively) further reflected the clear water conditions. The TN and TP concentrations of 0.11 mg/L and 0.04 mg/L, respectively, in the surface waters were also indicative of moderately enriched conditions. The chlorophyll concentration of 6.9 ug/L was well below the eutrophy criterion of 10 ug/L.

Fecal coliform bacteria densities at the five beaches and three marinas surveyed were well below the primary contact standard of 200 colonies/100 mL with one exception, ST-42, the beach located near the ramp in the Stockton Recreation Area. The bacterial density at the community beach was 260 colonies/100 mL. In contrast, the companion beach on the south side of the cove had 75 colonies/100 mL. The remaining bacterial densities were as follows: Cedar Beach, 5/100 mL; Ruark Bluff Beach, 15/100 mL; State Park Beach, 8/100 mL; Orleans Trail Marina, 14/100 mL; State Park Marina, 8/100 mL; and Mutton Creek Marina, 9/100 mL. A final location, the back end of a main lake cove below a hog operation in the Big Sac arm, was sampled at the request of project personnel. No runoff was present and the fecal coliform density was negligible at 2 colonies/100 mL. Additional sampling during runoff events will be necessary to document any impacts to the lake.

c. **Outlet**. The stilling basin was adequately oxygenated (6.6 mg/L) during the 29 July survey. The water temperature of 27.3 ^{o}C was representative of existing conditions in the tributary streams. Other ambient parameters were within satisfactory ranges for the summer period. Turbidity and TSS were low at 3.9 NTU and 5 mg/L, respectively. Nutrient levels were within mesotrophic ranges (TN, 0.21 mg/L and TP, 0.04 mg/L). And, finally, no herbicides were detected in the outflow.

4. **Future conditions**.

The water quality of Stockton Lake is excellent; however, lowered water quality over the last decade in the Little Sac River, resulting from the Springfield Northwest Sewage Treatment Plant discharges and run-off from the city's expanding landfill, indicates the reservoir's future water quality may also be impacted by accelerating eutrophication. These impacts and the high total iron and manganese contributions of the inflows may adversely affect the quality of water available to the Springfield water supply pumping plant, which went on line in 1996 in the Little Sac arm.

5. **Recommendations**.

It is highly recommended that the continuous monitoring of the reservoir's discharge by project personnel during the warm weather months be continued. The continuous downstream monitor is critical to meeting State water quality standards for dissolved oxygen in the tailwater. Future reservoir, inflow, and downstream monitoring will be guided by the results of the HEC-5Q modeling study. However, with the current funding and staffing levels, monitoring will again be limited to a single survey in the summer of 2000.